

OBJECTIVE 28: RELOCATION, RE-ENTRY, AND RETURN - DECISION MAKING

OBJECTIVE

Demonstrate the capability to develop decisions on relocation, re-entry, and return.

INTENT

This objective is derived from NUREG-0654 which provides that OROs should develop plans and procedures for re-entry and recovery. (See evaluation criteria from Planning Standards A., I., J., M., and N.) This objective addresses functions and operations that take place during the post-emergency phase (intermediate phase) of an emergency. At the time that NUREG-0654 was published, **re-entry** and **recovery** was used as broad general terms encompassing what is now referred to as **relocation**, **re-entry**, **return**, and **recovery**. The revised terminology is used in Chapters 4 and 7 of the Environmental Protection Agency's (EPA) "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents," EPA 520/1-75-001-A dated January 1990, in defining protective action guides (PAG) and also used here.

The capability of OROs to make decisions on relocation, re-entry and return of the general public is essential for the protection of the public from the direct long-term exposure to deposited radioactive materials from a severe accident at a commercial nuclear power plant.

This objective is supported by input from Objective 24, Post-Emergency Sampling and Objective 25, Laboratory Operations. Decisions required by this objective are essential as input for Objective 29, Relocation, Re-entry, and Return - Implementation.

The population should be protected from exposure to the airborne plume and from short term exposure to contamination deposited from the plume by evacuation and sheltering. Evacuation and sheltering are short-term actions quickly taken to avoid exposure that may be delivered at a high rate. State and local plans usually provide for evacuation before plume arrival, if possible. After plume passage, areas are monitored to determine whether individuals who were sheltered should now be evacuated to prevent them from exceeding the plume PAGs from short-term exposure to high concentrations of deposited materials.

Relocation, on the other hand, is a less urgent protective action that is taken to avoid chronic exposure to gamma radiation from deposited materials in areas where the projected first year dose exceeds the relocation PAGs. Exposure to deposited material received for a few days after the plume has passed will not add significantly to the total exposure received in one year, the dose integration time for the relocation PAGs.

Many individuals who were evacuated to prevent exposure to the plume may be able to

return for unrestricted occupancy as soon as monitoring data confirm the location of areas that were not significantly contaminated by the plume. Others who were evacuated from areas found to be highly contaminated by the plume will not be able to return for occupancy until the area is decontaminated. These evacuees are converted to a **relocation** status. Those who were evacuated from areas found to be only slightly contaminated by the plume, may return after careful monitoring and data analyses to determine whether the projected dose will exceed the relocation PAGs. Therefore, the PAG for **relocation** also applies to **return**.

When relocation is implemented, a **restricted zone** is established and individuals inside the zone are relocated. Reentry into this zone is allowed only under controlled conditions. Access control points are established at or near the boundary of the zone to provide for radiation protection of individuals who must enter. The reasons for re-entry would be either to retrieve valuable property or to work, either on recovery, or other allowed tasks.

Radiation exposure for individuals re-entering the restricted zone should be in accordance with the emergency response plan. Radiation exposure is usually controlled in accordance with occupational exposure limits. In the event that radiation exposure limits are not provided in the plan, they should be in accordance with provisions of Chapter 4 of the EPA PAG Manual. This guidance provides that individuals who are permitted to re-enter a restricted zone to work, or for other justified reasons, should do so under controlled conditions in accordance with dose limitations and other procedures for control of occupationally-exposed workers. This guidance also states that ongoing doses received by these individuals from living in a contaminated area outside the restricted zone need not be included as part of this dose limitation applicable to workers. And, in addition, dose received previously from the plume and deposited materials during the early phase of the nuclear incident, need not be considered. Exposure limits applicable to emergency workers (see Objective 5, Emergency Worker Exposure Control) should not be applied during the post emergency phase of an accident unless a new emergency occurs where short duration exposure of workers is required to save lives, prevent large populations dose, or to protect valuable property.

Later actions may be needed to provide additional radiation protection for some individuals not relocated from low-level contaminated areas.

DEMONSTRATION CRITERIA

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CRITERION

- I.10** **1.** **Areas requiring relocation of the public are identified by**
M.1. **comparing simulated measurements to decision criteria.**

Explanation

OROs should demonstrate the capability to estimate integrated dose in contaminated areas and to compare these estimates with PAGs, apply decision criteria for relocation of those individuals in the general public who have not been evacuated but where projected doses are in excess of relocation PAGs, control access to evacuated areas, apply decision criteria for selected re-entry of specific individuals into the restricted zone where necessary, and develop criteria for the orderly return by the general public to areas with contamination levels below the EPA relocation PAGs.

The standard approach for determination of the boundary of the area for relocation is based on a combination of laboratory measurements to determine the mix of radionuclides in the deposited materials and field measurement of gamma exposure rates. In this approach, the results of laboratory analyses are used to calculate the gamma exposure rate at one meter height (waist level) that corresponds to the relocation PAG. The boundary corresponding to this gamma exposure rate becomes the boundary of the restricted zone. Individuals inside the boundary are relocated, and individuals who have been evacuated to avoid plume exposure are permitted to gradually return to residences and businesses outside this boundary.

Under this standard approach, laboratory measurements are made of the relative concentrations of important radionuclides in samples from surfaces where radioactive materials have been deposited from the plume. These are used to calculate exposure rate conversion factors that translate from gamma exposure rate measurements [milliroentgen per hour (mR/h)] taken with portable field instruments to the first year dose which is comparable to the relocation PAG. They are also used to calculate the gamma exposure rate in the field that corresponds directly to the relocation PAG. This exposure rate can be used to identify the boundary of the restricted zone. These conversion factors should be recalculated frequently (daily during the first week after the accident) to account for the rapid decay of short-lived radionuclides. For more information on this process, refer to Chapters 4 and 7 of the EPA Manual of Protective Action Guides and Protective Actions for Nuclear Incidents.

As an **optional approach**, a temporary boundary may be established that corresponds to the location of a pre-determined gamma exposure rate. This exposure rate is conservatively set such that individuals outside this boundary cannot exceed the relocation

PAG. The gamma exposure rate (mR/h) corresponding to this boundary is typically the relocation PAG expressed in milliroentgen (mR) divided by the number of hours in one year. For a two rem PAG, this is $2000 \text{ mR} / 8760 \text{ hours} = 0.23 \text{ mR/h}$. Under this option, the relocation area would be much larger than the **restricted zone** that will be later established based on the relocation PAG. It is anticipated that within a few days after its establishment, after detailed radiation measurements and analyses are completed, this temporary boundary will be moved to the location of the final boundary of the restricted zone. This option is provided as a method for preventing a possibly confusing situation where evacuees are permitted to gradually return to low-level contaminated areas may be temporarily prevented from returning to areas where other individuals are continuing to live. This approach does not alter the relocation PAG, but is offered as an optional method for its implementation. As a result, field monitors need only search for the locations where the exposure rate is equal to the pre-determined conservative exposure rate. These points will locate the boundary of the temporary relocation area. Development of the factors convert from exposure rate (in mR/h) to projected dose (in rem) can be delayed until the decision is made to establish the final boundary of the restricted zone.

Extent of Play

Under this criterion, all activities should be completed as they would be in an actual emergency. Assessments should be based on simulated data developed as part of the scenario and provided by controllers to field monitoring teams and/or laboratories as appropriate. The dose assessment group should receive data from the laboratory(ies) or field teams.

Under the **standard approach**, field samples of vegetation and soil should have been sent to the laboratory(ies) for analyses as demonstrated under Objective 24, Post Emergency Sampling. The dose assessment group should demonstrate the capability to use simulated data from the laboratory(ies) to calculate the exposure rate conversion factors. They should demonstrate the capability to use the data on field measurements of gamma exposure rates after plume passage, along with the exposure rate conversion factors, to plot on a map the location of the area from which the population should be relocated (the restricted zone).

Under the **optional approach** the dose assessment group should demonstrate the use of data on field measurements of gamma exposure rates after plume passage and the pre-determined gamma exposure rate to plot on a map the boundary of the area from which the population should be relocated.

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2. **Decision criteria and strategy are followed in decisions to allow re-entry into controlled areas.**

Explanation

Under the standard approach, the responsible OROs should demonstrate the capability to establish control points along access roads into the restricted zone. These should be either at the boundary of the restricted zone or at a convenient location outside the zone. These will not necessarily be the same **access control** points established for the emergency phase of the accident. OROs should demonstrate the capability to control re-entry and exit of individuals to protect them from excessive radiation exposure and for exit of vehicles and other equipment to avoid spreading contamination outside the restricted zone.

Examples of control procedures are: the assignment of, or checking for, direct-reading and non-direct-reading dosimeters for emergency workers; questions regarding the individual's objectives and locations expected to be visited and associated time frames; availability of maps and plots of radiation exposure rates; advice on areas to avoid; and procedures for exit including: monitoring of individuals, vehicles, and equipment; decision criteria regarding decontamination; and proper disposition of emergency worker dosimeters and maintenance of emergency worker radiation exposure records.

Responsible OROs should demonstrate the capability to develop a strategy for authorized **re-entry** of individuals into the restricted zone, based on established decision criteria. OROs should demonstrate the capability to modify those policies for security purposes (e.g., police patrols), maintenance of essential services (e.g., fire protection and utilities), and other critical functions. They should demonstrate the capability to use decision making criteria in allowing access to the restricted zone by the public for various reasons, such as to maintain property (e.g., to care for farm animals or secure machinery for storage) or to retrieve important possessions. Coordinated policies for access and exposure control should be developed among all agencies with roles to perform in the restricted zone. OROs should demonstrate the capability to establish policies for provision of dosimetry to all individuals allowed to re-enter the restricted zone. The extent that OROs need to develop policies on re-entry will be determined by scenario events.

Extent of Play

Demonstration of this criterion should be accomplished in a group setting with representatives of all major organizations. Decisions should be made regarding the location of control points and policies regarding control should be explained. Pre-printed forms should be presented and explained.

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CRITERION

I.10., M.1.

3. Return recommendations are developed.

Explanation

Return is when evacuees are allowed to reoccupy their homes and businesses on an unrestricted basis. Under the standard approach (as discussed in Demonstration Criterion 1), return is a two step process. As a first step, evacuees are permitted to return early only to areas unaffected, (or affected only slightly) by the plume. The boundary of this area is established on the basis of field measurements of gamma exposure rates as is done for the optional approach. This boundary typically corresponds to the location of exposure rates of 0.23 mR/h, including natural background radiation. Return to this temporary boundary may take place as soon as the release has been stopped, the plume has passed, and environmental measurements have verified the area contaminated by the plume. For the second step, return is permitted to the boundary of the restricted zone that is based on the relocation PAG. This should be a gradual process as field monitoring and laboratory analyses discussed under Demonstration Criteria 1 confirm that the boundary of this zone is stable.

Under the optional approach, the boundary of the relocation area, established under Demonstration Criteria 1, is the boundary to which evacuees may initially return. As in the standard approach discussed above, the second step of return, up to the boundary of the restricted zone that is established on the basis of the relocation PAG, should be a gradual process.

Responsible OROs should demonstrate the capability to determine conditions that permit the cancellation of the emergency classification level (ECL) and relax associated restrictive measures. OROs should demonstrate the capability to base **return** recommendations (i.e., permitting populations which were previously evacuated to reoccupy their homes and businesses on an unrestricted basis) on measurements of radiation from ground deposition.

Extent of Play

Responsible OROs should demonstrate the capability to use either the standard approach or the optional approach and simulated environmental measurements provided by the controller to identify the location of the boundaries of areas to which return is permitted. Environmental measurement data should be developed as part of the scenario.

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4. Decisions are made regarding assistance to individuals who are affected by the emergency.

Explanation

Following the emergency phase, many of the evacuees may not be able to return to their homes and businesses until recovery (decontamination) is completed. Long term decisions on recovery of areas that are restricted from occupancy due to contamination are not required for exercises. However, it may be important to rapidly restore some of the services that have been interrupted by relocation of the public. OROs should demonstrate the capability to identify services and facilities that require restoration within a few days, and to identify the procedures and resources for their restoration. Examples of these services and facilities are medical and social services, utilities, roads, schools, and intermediate term housing for relocated persons.

Extent of Play

Demonstration of this criterion should be accomplished in a group setting with representatives of all major organizations. The conditions facing relocated individuals will be determined by decisions made under Demonstration Criteria 1 and 2. Discussions should be held regarding the actions that will be needed, priorities, and the processes for implementation.

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CRITERION

**A.1.b.
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5. Decisions are coordinated, as appropriate, with other organizations.

Explanation

The implementation of decisions on relocation, re-entry, and return will involve several OROs. The decision makers for protecting the public should demonstrate the capability to identify the response organizations that will need to be involved in the implementation of the decisions. They should demonstrate the capability to involve other response organizations in the decision making process to assure that the decisions can be reasonably implemented.

Extent of Play

Demonstration of this criterion should be accomplished in a group setting with representatives of all major organizations. Resources in the plans for assistance, concurrence, and information transfer should be identified, and availability of methods for communication of these activities should be confirmed.

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CRITERION

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6. All activities described in the demonstration criteria for this objective are carried out in accordance with the plan, unless deviations are provided for in the extent-of-play agreement.

Explanation

Responsible OROs should demonstrate the capability to follow policies, implement procedures, and utilize equipment and facilities contained in their plans and procedures. OROs should demonstrate that they can follow sequences outlined in the various procedures and perform specified activities, as necessary.

Extent of Play

Under this criterion, all activities should be carried out as specified in the plan, unless deviation from the plan is provided for in the extent-of-play agreement.

CLARIFICATION OF TERMS

The following definitions describe the limited meaning of terms in the context of the Exercise Evaluation Methodology and may vary from the full technical definition for all circumstances.

Emergency phase refers to the initial phase of response actions, during which actions are taken in response to a threat of release or a release in progress.

Recovery refers to the process of reducing radiation exposure rates and concentrations of radioactive material in the environment to acceptable levels for return by the general public for unconditional occupancy or use after the emergency phase of a radiation emergency.

Re-entry refers to temporary entry of individuals into a restricted zone under controlled conditions.

Relocation refers to a protective action, taken in the post-emergency phase, through which individuals not evacuated during the emergency phase are asked to vacate a contaminated area to avoid chronic radiation exposure from deposited radioactive material.

Restricted zone refers to an area of controlled access from which the population has been evacuated or relocated.

Return refers to reoccupation of areas cleared for unrestricted residence or use by previously evacuated or relocated populations.